

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of) Confirmation No. 9076
David J. Cooperberg et al.)
Application No.: 10/024,208) Group Art Unit: 1763
Filed: December 21, 2001) Examiner: Luz L. Alejandro Mulero
For: TUNABLE MULTI-ZONE GAS) Appeal No.: 2008-6350
INJECTION SYSTEM)
)

**Request Under 37 C.F.R. §§ 41-52(a)(1) For Rehearing Before An
Expanded Panel And That The Decision Affirming The Examiner Be Designated
A New Ground of Rejection Under 37 C.F.R. § 41.50**

Mail Stop APPEAL BRIEF - PATENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Appellants request rehearing before an expanded panel due to issues of exceptional importance raised in the Decision dated February 27, 2009 in Ex parte David J. Cooperberg et al. (Appeal No. 2008-6350 regarding Serial No. 10/024,208). These exceptional issues of importance include:

I. The proper weight to be given claim elements reciting functional relationships;

II. whether it is proper to not consider prior art references in their entirety; and

III. whether it is proper to ignore substantial evidence of nonobviousness.

If Appellants Request for Rehearing is denied and/or it is determined that the Merits Panel's decision will not be changed, Appellants request that the Decision be designated as a new ground of rejection because:

IV. the Merits Panel took substantially different positions than the Examiner with regard to the teachings of the prior art and the weight to be given the Cooperberg Declaration.

I. The Proper Weight To Be Given Claim Elements Reciting Functional Elements

A. Failure to Properly Interpret Functional Relationships Recited in the Claims

In the Examiner's Answer, the Examiner dismissed functional relationships recited in the claims as "intended use" limitations. For instance, in response to Appellants' argument that Goodyear (a secondary reference applied against the claims) teaches away from the claimed invention, the Examiner stated:

even assuming that such statement is true, it should be noted that: a) the rejected claims do not require that the common gas supplies identical gas composition to the gas lines, and b) such limitation is directed to a method limitation instead of an apparatus limitation, and a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If prior art is capable of performing the intended use, then it meets the claim. Note that the apparatus of Ni et al. modified by Chang et al. or Murugesh et al. and Arami et al., Goodyear et al. or Balance et al., is capable of supplying an identical gas composition to the gas lines. (See paragraph bridging pages 17-18 of Examiner's Answer).

As explained below, the claims are directed to a plasma processing system wherein a common gas supply necessarily delivers the same process gas (or identical gas composition as argued by the Examiner) to an injector. The Examiner's contention that such limitations can be treated as "intended use" is reversible error. In *Ex parte Urbahn et al.*, Appeal 2009-1040 decided March 5, 2009, the Examiner's refusal to give patentable weight to a claim limitation because "it constitutes a functional limitation" was reversed. The Merits Panel makes the same error in the present appeal and because the Merits Panel has taken a claim interpretation

approach inconsistent with other Merits Panels, it is submitted that an expanded panel is needed to address this disagreement among different Merits Panels as to the proper weight to be given functional limitations.

1. "Common Gas Supply" And "Process Gas"

The claimed plasma processing system includes a "common gas supply" and other components which cooperate to deliver "process gas" from the "common gas supply" to an injector which supplies the process gas into a processing chamber wherein the process gas is energized into a plasma state. However, these claim features are not properly interpreted in the Decision which states:

We interpret the term "common gas supply" . . . to encompass any gas supply structure capable of supplying the same gas to both gas lines . . ." The term 'common gas supply' does not encompass a particular gas such as a "process" gas as stated in claim 1, "a gas mixture" as stated in claim 5, or "the same gas composition" as Appellants contend, because such recitations do not structurally limit any apparatus component of the claimed system. (Decision, page 6, lines 7-16 citing *In re Otto*, 312 F.2d 937 (CCPA 1963), *In re Rishoi*, 197 F.2d 342 (CCPA 1963), *In re Smith*, 36 F.2d 302 (CCPA 1929), *In re Young*, 75 F.2d 996 (CCPA 1935)). (Emphasis added, Decision at page 6)

It is respectfully submitted that the Merits Panel erred in not interpreting "common gas supply" as a system component claimed with a particular functional relationship to other components of the system. The common gas supply necessarily delivers the same "process gas" from the common gas supply to first and second lines supplying the process gas to on-axis and off-axis outlets. The line of cases cited in the Decision do not support the Merits Panel's failure to give patentable weight to the functional limitations recited in Appellants' claims. For instance, Otto was cited with approval in *In re Casey*, 370 F.2d 576, 152 USPQ 235

(CCPA 1967) wherein the court stated that the manner in which a machine is to be utilized is not germane to the issue of patentability of the machine itself. This has no relevance to the appealed claims which are directed to a plasma processing system wherein various components are defined with particular functional relationships. For example, the gas injector supplies "process gas" at flow rates that are independently varied between on-axis and off-axis outlets into the processing chamber (see gas injector clause of Claims 1, 7, 9, 10, 41 and 42) and this process gas is energized into a plasma state (see last clause of Claims 1, 7, 9, 10, 41 and 42).

a. **Claim 1**

Casey was cited in *Ex parte Curry*, 84 USPQ 2d 1272 (BPAI 2005) for the proposition that statements of intended use do not serve to distinguish structure over the prior art. However, Claim 1 does not distinguish over the prior art solely on the basis of statements of intended use. Instead, in Claim 1, the "common gas supply" is claimed as an element of a plasma processing system and other claimed elements recite specific operating features of the claimed plasma processing system such as "flow controllers" operable to supply "process gas" from the common gas supply at flow rates that are independently varied between the on-axis outlet and the off-axis outlets into the processing chamber (Claim 1, lines 19-20). Thus, rather than reciting statements of intended use, independent Claim 1 recites functional relationships between the claimed components which must be given patentable weight. See *Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc.*, 381 F.2d 111, 1117-1120, 72 USPQ 2d 1001 (Fed. Cir. 2004). (A functional limitation must be evaluated and considered, just like any other limitation, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used.)

This is not a case where the claimed apparatus differs from the prior art only by the manner or method in which it is used as was the situation in Casey and the line of cases cited in the Decision which hold that a statement of intended use does not distinguish over an apparatus capable of performing the same function. In the present case, the functional relationships recited in independent Claim 1 are not present in the prior art cited against the claims. For instance, the primary reference Ni does not have flow controllers capable of independently varying flow rates of process gas from a common gas supply to the on-axis and off-axis outlets, Chang and Murugesh disclose valve arrangements wherein different gas sources supply different gases to different outlets, and the showerheads of secondary references Arami, Balance and Goodyear supply gas from one or more gas sources to a multitude of on-axis outlets extending across the chamber. Thus, as a threshold issue, it is submitted that the Decision erroneously interpreted "common gas supply" as not encompassing delivery of the same gas composition to the injector and ignored the functional relationship of the "common gas supply" to the other components in Claim 1.

b. Claims 7, 9, 10, 41 and 41

Independent Claims 7, 9, 10, 41 and 42 do not recite the "flow controllers" and "operable to" limitations recited in Claim 1. However, these claims recite structural features not taught by the applied references and functional relationships which the cited references are not capable of exhibiting. For instance, like Claim 1, "process gas" and "common gas supply" are also recited in Claims 7, 9, 10, 41 and 42 as well as other limitations describing functional relationships to the on-axis and off-axis outlets, i.e., (1) the on-axis outlet receives "process gas" from a common gas supply,

(2) the off-axis outlets receive the process gas from the common gas supply, (3) the gas injector supplies the process gas at flow rates independently varied between the on-axis and off-axis outlets and (4) the "common gas supply" is in fluid communication with first and second gas lines which are in fluid communication with the on-axis outlet and off-axis outlets, respectively. All of the independent claims recite that the process gas (Claim 1, lines 13, 19, 23; Claim 7, lines 11, 12, 14, 21; Claim 9, lines 10, 12, 14, 22; Claim 10, lines 14, 22; Claim 41, lines 13, 19, 22; Claim 42, lines 14, 21, 24) is supplied through the on-axis and off-axis outlets which are in fluid communication with the "common gas supply" through either the first or second gas line. In view of *Innova/Pure Water*, such functional limitations must be given patentable weight. The applied references (Ni, Chang, Murugesh, Arami, Goodyear and Balance) do not disclose apparatus capable of performing the functional relationships recited in Claims 1, 7, 9, 10, 41 and 42. When "common gas supply" and "process gas" as well as their claimed functional relationships with the other claimed components are properly interpreted, it will be evident that the §103 rejections cannot be sustained.

c. **Inconsistent Application of Functional Claim Language Legal Precedent**

The reasons why the interpretation of "common gas supply" and its recited functional relationship with other claimed components which deliver "the process gas" to outlets of the claimed injector present an exceptional issue of importance is that the Merits Panel's Decision in this case is out of line with other Merits Panel decisions such as *Ex parte Soninen*, Appeal No. 2008-3846 decided February 25, 2009 wherein one of the present Merits Panel judges (Judge Warren) dissented from the other judges due to disagreement on "the interpretation advanced by the

Examiner" (*Soninen* at page 13, lines 1-23). In the present case, Judge Warren persuaded the other members of the Merits Panel to join him in adopting the claim interpretation position rejected by the majority in *Soninen*. Such inconsistent approaches to claim interpretation of functional limitations in apparatus claims leads to uncertainty in receiving a fair hearing before the Board of Patent Appeals and Interferences.

One objective of the claimed plasma processing system is to improve center-to-edge uniformity and mean etch or deposition characteristics (specification at page 8, lines 21-28). This objective is achieved by partitioning process gas injection between injector outlets and adjusting the ratio of flow through the outlets (specification at page 9, lines 8-15). The balance between on-axis and off-axis injection determines the connective flow field downstream from the nozzle tip so that spatial density of reactive species of the plasma (specification at page 9, lines 15-23). Thus, it is possible to provide different ratios of on-axis to off-axis flow for optimum uniformity for different etch applications or for "different recipe steps within an etch application" (specification at page 9, lines 24-29).

The claimed system is designed to distribute process gas between on-axis and off-axis outlets of the injector. This functional relationship is recited in each of the independent claims. The Merits Panel erroneously interpreted the independent claims as not requiring the functional relationships explicitly recited in each independent claim. Thus, should Appellants Request for Rehearing before an expanded panel be granted, it is respectfully requested that the functional relationships recited in each of the independent claims be given patentable weight.

As explained below, when the claims are properly interpreted, and due consideration is given to Appellants substantial evidence of nonobviousness, reversal of the §103 rejections will be in order.

II. Whether It Is Proper To Not Consider Prior Art References In Their Entirety

A. Legal Standard For Consideration Of Prior Art

In *In re ICON Health and Fitness Inc.*, 937 F.3d 1376, 83 USPQ 1746 (Fed. Cir. 2007), the court made the following observations about when a reference is considered to teach away:

A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. *In re Gurley*, 27 F.3d 551, 553, 31 USPQ 2d 1130 (Fed. Cir. 1994). See [*KSR Int'l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 82 USPQ 2d 1385 (2007)] (explaining that when the prior art teaches away from a combination, that combination is more likely to be nonobvious).

Also, it is improper when making a §103 rejection "to pick and choose from any one reference only so much as will support a given position, to the exclusion of other parts necessary to the full appreciation of what the reference fairly suggests to one of ordinary skill in the art". *In re Wesslau*, 353 F.2d 238, 241 (CCPA 1965). In the present case, the Decision improperly relies on a background portion of the secondary Goodyear reference to the exclusion of other portions of Goodyear teaching away from doing what the Merits Panel considered obvious in view of Goodyear's background discussion.

The Merits Panel relied on an isolated teaching in Goodyear which is criticized by Goodyear as producing non-uniform plasma deposition and etching (see quote from Goodyear in Decision at page 14, lines 1-14 and Goodyear's discussion at

column 1, lines 54-67). Goodyear overcomes the problem of non-uniformity arising from using the same gas mixture supplied at different flow rates to central and peripheral areas by instead using separate gas supplies to control the gas composition as follows:

The present invention is based on a recognition that non-uniformities in plasma treatments over large areas can result from the different gases in the gas mixture being depleted at different rates in the particular treatment (whether deposition, or etching, or whatever) and that the effect of the different depletion rates over the large areas can be most easily compensated (at least partially) by supplying to the second area a mixture which is richer in the reaction gas which depletes at a faster rate. This approach permits the gas parameters to be determined first by the desired device characteristics from the plasma treatment (e.g., the compositions and quality of a deposited film) and then it permits achievement of these gas parameters by controlling the flow rates and gas composition of the separate supply lines. (Emphasis added, Goodyear at column 2, lines 54-67).

In addition to not considering Goodyear in its entirety, the Decision cites Balance for teachings discredited by Goodyear. For instance, FIG. 8 of Balance is cited for disclosure of a showerhead 300 having a common gas supply line from gas supply 314 which communicates with gas line 312 having flow controller 318 for central chamber 308 and gas line 310 having flow controller 316 for annular outer chamber 306 (Decision at page 15, lines 16-24). The embodiments in FIGS. 1-7 of Balance are directed to rapid thermal processing (RTP) systems in which a problem of hole erosion at the center of a showerhead is addressed by use of a dual zone showerhead so that the pressure of gas supplied to the center holes can be reduced to compensate for their larger hole size (column 3, lines 1-15). Such is not a problem for Ni's injector which has less than 10 holes and is designed for a particular etch or deposition application (see Ni at page 13, lines 9-19). The FIG. 8 embodiment of Balance is stated to be useful in a plasma etch system (column 8,

lines 34-35) but such a plasma processing system is identical to that criticized by Goodyear as producing non-uniform etching and deposition (see Goodyear at column 1 lines 54-67). The Decision fails to address Goodyear's teachings away which are applicable to the FIG. 8 Balance embodiment and the Merits Panel's conclusory statements do not suffice as a rational basis to modify Ni as proposed by the Examiner.

Appellants urge the expanded panel to hold that prior art references must be considered in their entirety and reverse the §103 rejections as improperly based on a portion of Goodyear to the exclusion of Goodyear's explicit teachings away. Consideration of Goodyear in its entirety would have led one of ordinary skill in the art to expect Balance's FIG. 8 embodiment to produce unacceptable non-uniform results. Further, as explained below, Ni's system was designed to improve over showerhead arrangements and consideration of Ni in its entirety would have taught a person of ordinary skill to not consider inferior showerhead arrangements as a source of changes to Ni's injector arrangement. Ni's injector is designed for a particular process application and adding extra features such as separate gas lines and valves would have no purpose other than to add expense and unnecessary features (see Ni at page 14, lines 3-15).

The remaining secondary reference Arami does not relate to plasma processing. Instead, Arami discloses a heat processing apparatus for forming a film on a target object (column 1, lines 5-10). As pointed out in the Decision, Arami's showerhead injector section 35 has three concentrically arranged gas chambers 37A, 37B, 37C in communication with three gas sources 41, 42, 43 which provide various gas mixtures to the various zones via mass flow controllers 44A, 44B, 44C

(Decision at page 13, lines 2-13). Although Arami does not relate to plasma processing and thus is not analogous to the Ni injector plasma processing system, Arami leads away from supply of the same process gas to different zones of the showerhead. Moreover, even if Arami is considered equivalent to Goodyear and Balance for disclosure of connecting a single gas to multiple regions of a showerhead, Goodyear explicitly discredits use of an arrangement which delivers the same gas to inner and outer zones in plasma processing of substrates due to non-uniformity in deposition and etching. Given that Ni's injector is disclosed as an improvement over showerheads and has outlets already designed to achieve desired delivery of process gas, the record fails to set forth an "apparent reason to combine the known elements in the fashion claimed" *KSR* at 1741.

Without offering any countervailing evidence of its own, the Merits Panel stated that "[w]e are unpersuaded of a 'teaching away' from a common gas supply by the disclosure of a problem with depletion of one of the reaction gases delivered through a showerhead injector" (Decision at page 22, lines 3-6 citing pages 30-30 of Appeal Brief, Goodyear at column 4, lines 48-56 and Cooperberg Declaration at paragraph 12, pages 6-8 of Reply Brief). Other than this conclusory statement, the Merits Panel contends that Goodyear:

"would have led one of ordinary skill in this art to the reasonable inference that the process gas supplied to each of the areas 12a, 12b, of the showerhead injector can be of the same composition." (Decision at page 11, lines 7-13).

Ignoring Goodyear's teaching away cannot be a reasonable inference to do what Goodyear says not to do. The Merits Panel provides no apparent reason to ignore the discussion in Goodyear criticizing the supply of the same gas composition at different flow rates to central and peripheral areas (see Goodyear at column 1,

lines 39-67 and column 2, lines 54-67). Incredulously, the Merits Panel contends that Goodyear's explicit teaching away would have led a person of ordinary skill to do what Goodyear says produces unacceptable results. Appellants urge the expanded panel to consider Goodyear in its entirety. The evidence of record shows the expectation of nonuniformity when using the same gas to different regions of a showerhead. As such, the fact that the claimed plasma processing system can achieve uniformity supplying the same process gas to inner and outer regions in the chamber is a result which should be considered unexpected in view of Goodyear's teaching that a showerhead system supplying the same gas would produce non-uniform results.

In addition to ignoring Goodyear's teaching away, the Merits Panel ignores Chang's teaching away, i.e., Chang states:

"The top nozzle 96 and top vent 98 allow independent control of top and side flows of the gases, which improves film uniformity and allows fine adjustment of the film's deposition and doping parameters" (Chang at page 9, lines 25-28).

Chang discloses that inert gas such as argon can be flowed into the chamber to stabilize pressure before reactive process gases are introduced and the process gas can be $TiCl_4$ (Chang at page 15, lines 1-12). Because $TiCl_4$ would rapidly deposit on interior surfaces of dome 50 and disrupt the stability of the plasma and lead to uneven deposition, arcing and other problems (Chang at page 18, lines 4-13), all of the $TiCl_4$ passes into the process chamber through nozzle 96 and hydrogen enters through vent 98 (Chang at page 18, lines 14-21). Despite this clear teaching away from mixing the $TiCl_4$ and H_2 and supplying the same gas to nozzle 96 and vent 98, which is acknowledged in the Decision (Decision at page 18, lines 4-12), the Merits Panel nonetheless erroneously states Chang's disclosure is

"essentially the same as that of Arami, Goodyear, and Balance" (Decision at page 24, lines 14-15).

The Merits Panel disregards Murugesh's teachings regarding the FIG. 3 embodiment wherein "process gas" is fed to "gas outlets 85" (however, only one outlet is apparent from FIG. 3) and "cleaning gas" is fed to outlets 247 (unlike the FIG. 1A, 2A and 2B arrangements which deflect the cleaning gas via baffles 248, the FIG. 3 embodiment has two outlets fed by separate conduits connected to conduit 170 extending from a cleaning gas supply 125). Murugesh teaches away from feeding the same gas to the outlet 85 and outlets 247. Instead, Murugesh teaches that deposition gas 70 is supplied through outlet 85 to form deposits such as SiO₂ on substrates and after the deposition process is completed the substrate 25 is removed, the chamber is cleaned by feeding the cleaning gas through outlets 247 (Murugesh at column 8, lines 1-26). The Merits Panel's selective findings of fact concerning Murugesh, Ni, Chang and Balance distort the record and improperly fail to evaluate the teachings of the references in their entirety.

As pointed out by the Court in *KSR* in a case involving more than simple substitution of one known element for another or mere application of a known technique to a piece of prior art ready for improvement, to determine whether there was an apparent reason to combine known elements in the way the patent claims, it will often be necessary to look to:

"interrelated teachings of multiple patents; the effects of demands known to the design community or present in the market place; and background knowledge possessed by a person having ordinary skill in the art." (*KSR* at 1396).

In *KSR* "the question was where to attach the sensor" (*KSR* at 1399). In the present case, Ni teaches a fully functioning injector not needing improvement and

thus there can be no apparent reason to separately supply gas to the on-axis outlet and off-axis outlets. The Ni injector is designed to achieve the desired results when used for a particular etch application (Ni at page 14, lines 3-15). The Decision fails to provide a proper evidentiary basis for motivation to a designer to change the Ni injector in a manner which would result in the claimed plasma processing system. For instance, in aluminum etch applications the injector does not include an on-axis outlet (Ni at page 14, lines 16-23) yet the Merits Panel contends that it would be obvious to add an on-axis outlet with separate gas line and valves to turn off the on-axis outlet. The Decision fails to provide an apparent reason why the designer would add an unneeded outlet and valve to turn it off.

If the designer KSR considered Chang in its entirety, would the designer want to use Ni's injector for CVD and add a cleaning gas delivery feature? If so, there still would be no motivation to separate flow between Ni's on-axis and off-axis outlets. Clearly, nothing in Chang provides such motivation.

If the designer considered Murugesh's FIG. 3 embodiment, would the designer want to use Ni's injector for CVD and add cleaning gas delivery feature? If so, what would motivate the designer to separate flow between Ni's on-axis and off-axis outlets? Clearly, nothing in Murugesh provides such motivation.

This leaves the three showerhead arrangements of Goodyear, Arami and Balance. Of these three references, Goodyear relates to plasma processing systems and Goodyear clearly teaches away from feeding inner and outer chambers of a showerhead with the same gas composition. Goodyear achieves uniformity by using different gas supplies to change the gas composition. Arami too seeks to supply different gas compositions to inner and outer chambers. Only Balance's FIG.

8 shows an arrangement where the same process gas is fed to inner and outer chambers but Goodyear teaches such arrangements produce non-uniform results. So, the question becomes why would the designer ignore the teachings away in Goodyear and modify Ni to have a feature Ni does not need? The clear answer is they wouldn't. Thus, the prior art in this case does not meet the KSR standard for establishing a *prima facie* case of obviousness.

III. Whether It Is Proper To Ignore Substantial Evidence Of Nonobviousness

A. The Board Decision Improperly Rejected Evidence Submitted in the Cooperberg Declaration

In the Decision, the Board completely disagreed with the expert testimony of Declarant Cooperberg as follows:

"We find that Declarant Cooperberg states, among other things, that '[r]egarding gas flow, because a showerhead includes many holes, the gas exit velocity is normally sufficiently low,' and that '[t]he higher flow rate from a smaller number of holes for the claimed gas injector allows for more controlled directivity from the injector.'" (Decision at page 24, lines 1-5, citing Cooperberg Declaration paragraph 13).

"We disagree with Appellants' position. We determine that one of ordinary skill in this art would have had knowledge that the flow of gas to outlets of an injector can be regulated by dividing the injector into chambers in order to regulate gas flow and composition as evidenced by Chang, Murugesh, Arami, Goodyear, and Balance." (Decision at page 24, lines 6-14)

As explained below, there is no evidentiary basis for the Merit Panel's rejection of Declarant Cooperberg's evidence of nonobviousness. The Decision should be withdrawn and the §103 rejections should be reversed since the rejections are improperly based on conclusory statements of the Examiner which the Merits Panel adopted. The Decision also improperly rejected Appellants' rebuttal evidence on the basis that one of ordinary skill "would have had knowledge", a purely

conclusory view of the prior art which fails to adequately consider Appellants' rebuttal evidence.

As set forth in *In re Lee*, 277 F.3d 1338, 61 USPQ 2d 1430 (Fed. Cir. 2002):

Deferential judicial review under the Administrative Procedure Act does not relieve the agency of its obligation to develop an evidentiary basis for its findings. To the contrary, the Administrative Procedure Act reinforces this obligation. (PQ 1434)

In its decision on Lee's patent application, the Board rejected the need for 'any specific hint or suggestion in a particular reference' to support the combination of the Northrup and Thunderchopper references. Omission of a relevant factor required by precedent is both legal error and arbitrary agency action. (PQ 1434)

The 'common knowledge and common sense' on which the Board relied in rejecting Lee's application are not the specialized knowledge and expertise contemplated by the Administrative Procedure Act. Conclusory statements such as those here provided do not fulfill the agency's obligation. (PQ 143)

In *In re Sullivan*, 362 F.3d 1324, 84 USPQ 2d 1034 (Fed. Cir. 2007), the court explained the importance of giving due consideration to rebuttal evidence:

We agree with applicant that the Board improperly failed to consider the rebuttal evidence and we therefore vacate the Board's decision and remand for the Board to consider the declarations.

Rebuttal evidence is 'merely a showing of facts supporting the opposite conclusion.' *In re Piasecki*, 745 F.2d 1468, 1472 [223 USPQ 785] (Fed. Cir. 1984). Evidence rebutting a prima facie case of obviousness can include: 'evidence of unexpected results,' *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1369 [82 USPQ 2d 1321] (Fed. Cir. 2007), evidence 'that the prior art teaches away from the claimed invention in any material respect,' *In re Peterson*, 315 F.3d 1325, 1331 [65 USPQ 2d 1379] (Fed. Cir. 2003).

B. No Reason To Modify Ni

The primary reference Ni specifically teaches that the number of gas outlets and/or angle of injection can be selected to provide the desired gas distribution in a particular substrate processing regime (see paragraph 10 of Cooperberg Declaration

and Ni at page 9, lines 1-3). Ni states that the injector provides improved uniformity compared to "conventional injection through a showerhead . . . [and] polymer formation on the . . . showerhead can lead to undesirable particle flaking and contamination on the substrate" (Ni at page 17, line 22-page 18, line 4). Declarant Cooperberg also explained why showerhead arrangements would not be considered by persons of ordinary skill in designing an injector for an inductively coupled plasma system (Cooperberg Declaration at paragraph 13). Ni states that "other problems" with showerhead arrangements include additional costs to provide a sandwich structure which delivers gas across the window, temperature control, effects of plasma/gas erosion of the showerhead, ignition of plasma in the showerhead gas outlets, lack of process repeatability and Ni's injector arrangement overcomes the disadvantages of showerhead arrangements because it:

1. Allows for independent selection of the center gas feed location and chamber aspect ratio (Ni at page 19, lines 13-14).
2. Facilitates efficient utilization of process gas and improved gas delivery to the central region of large area substrates with minimal disturbance to plasma uniformity (Ni at page 19, lines 14-16).
3. Increases the convective transport relative to diffusive transport in the region immediately above the substrate (Ni at page 19, lines 16-19).
4. Facilitates efficient transport of etch by-products out of the substrate region, which can favorably impact etch uniformity and profile control (Ni at page 19, lines 19-22).

Despite the detailed explanation in Ni of the deficiencies of showerhead arrangements and Declarant Cooperberg's unrebutted opinion that persons skilled in the art would not have looked to the showerhead art to modify Ni's injector, the Merits Panel made a "finding" in rejecting Appellants' rebuttal evidence but without citing any evidence in support of its finding. If the Merits Panel's decision to reject

Appellants' rebuttal evidence rests on a "high level of skill" in the art or "common knowledge and common sense", such would constitute reversible error. *In re Rouffet*, 149 F.3d 1350, 47 USPQ 2d 1453 (Fed. Cir. 1998) ("a lofty level of skill alone does not suffice to supply a motivation to combine"). *In re Lee*, 277 F.3d 1338, 61 USPQ 2d 1430 (Fed. Cir. 2002).

The Decision cites *In re Skoll*, 523 F.2d 1392, 1397 (CCPA 1975) in support of the Merit Panel's conclusory argument that the Cooperberg Declaration did not establish unexpected results but rather "the evidence . . . does no more show what one of ordinary skill . . . would have reasonably determined from consideration of the combined teachings of Ni, Chang, Murugesh, Arami, Goodyear and Balance" (Decision at page 28, lines 15-20). However, there is no teaching in the cited references of the benefits discussed at paragraphs 4-11 of the Cooperberg Declaration. See *In re Nolan*, 553 F.2d 1261, 193 USPQ 641 (1977) (Board of Appeals erred where it concluded benefits were expected - mere conclusory statement of expectancy is insufficient). As explained earlier, Ni's injector is designed for a particular application but Appellants' discovered a need for adjustment of gas flows during sub-steps of a multi-step process. The claimed processing system provides unexpected advantages in this regard. (Cooperberg Declaration at paragraphs 9-11).

In *Ex parte Tosaka et al.*, Appeal No. 2008-3027 decided December 10, 2008, it was stated that a

"truly comparative showing must be derived from a comparison between the claimed subject matter and the closest prior art" (*In re Baxter Tranvenol Labs.*, 952 F.2d 388, 392 (Fed. Cir. 1991); *In re DeBlawwe*, 736 F.2d 699, 705 (Fed. Cir. 1984)) "and must be reasonably commensurate with the scope of protection sought by the

claims on appeal" (*In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983); *In re Uemens*, 622 F.2d 1029, 1035 (CCPA 1980).

In the present case, the evidence presented in the Cooperberg Declaration is not dismissed as not commensurate in scope with the claimed subject matter, but rather - allegedly it fails to establish unexpected results when compared to the combined teachings of the combined references. However, as explained above, Goodyear's teaching that supply of the same gas even with variable flow control to inner and outer zones lends to nonuniformity establishes that the ability of the claimed system to achieve uniform results should be considered an unexpected result.

Appellants provided uncontroverted evidence by way of the Cooperberg Declaration that showerheads operate in a fundamentally different way by use of at least 1000 on-axis holes arranged 2 to 2.5 cm away from the wafer whereas the Ni injector is arranged in a gap of about 15 cm from the wafer, a distance making zoned gas flow from an injector impossible due to the low gas flow rate and the predominantly diffusion dominated gas transport mechanism (Cooperberg Declaration at paragraph 13). Despite this uncontroverted evidence that one of ordinary skill would not consider the showerhead art in the design of an injector for the claimed plasma processing system, the Decision also does not explain why a person of ordinary skill would have been led to modify Ni to include different passages to separately feed the on-axis and off-axis outlets, a modification which would add cost in manufacturing and additional components by way of gas lines and control valves which would not be used for Ni's intended application. There is no dispute in the present record that the Ni injector is designed with the desired outlet

configuration and thus there is no need for independently controlling gas flows to the on-axis and off-axis outlets.

One advantage of Appellants plasma processing system is that it can be used to vary flow rates for multi-step etching, e.g., photoresist etch, hardmask open etch, antireflective coating etch, dielectric etch, trench etch, and gate oxide etch (Appeal Brief at page 14, lines 21-24). Different steps of a multi-step etch may require different center- and edge-zone gas flow rates (Appeal Brief at page 15, lines 6-9). The Cooperberg Declaration discusses the problem of providing a gas injector suitable for performing multi-steps in the same processing chamber (Appeal Brief at page 15, lines 13-19, Cooperberg Declaration at paragraph 6).

The Merits Panel ignored Appellants evidence of unexpected results stating "there is little support in the record for Appellants' contention that the problem addressed by the claimed injector is one of providing an 'etch uniformity in different etch steps of a multi-step etch process'" citing Appellants' Brief at pages 13-16, 21-24, 38-39 and paragraphs 3-6 of the Cooperberg Declaration (Decision at page 20, lines 12-16). Appellants disagree for two reasons. First, Appellants contend that there is ample support in the record as evidenced by the Merits Panel's citation of Appellants' Brief and the Cooperberg Declaration. Second, if the Merits Panel is using the term "record" to refer to Appellants specification, it is well established that Appellants' rebuttal evidence/arguments need not be contained in the specification. See *In re Chu*, 66 F.3d 292, 36 USPQ 2d 1089 (Fed. Cir. 1995) wherein the court stated that we have found no cases supporting the position that a patent Applicant's evidence and/or arguments traversing a Section 103 rejection must be contained within the specification.

Given Appellants' rebuttal evidence and the lack of evidentiary basis for the Merits Panel's conclusory statements dismissing Declarant Cooperberg's testimony, the totality of the record in the present appeal weighs in favor of patentability of the appealed claims.

C. Unexpected Advantages Of Claimed Plasma Processing System

The claimed plasma processing system can achieve different functions than the Ni injector (the claimed system can obtain uniform etching during a multi-step process during which gas flow rates of the on-axis and off-axis outlets can be changed). (See *In re Kuhle*, 526 F2d 553, 555, 188 USPQ 7, 9 (CCPA 1975) wherein the court stated "Appellants' have failed to show that the change [on the claimed invention] as compared to [the reference], result in a different function or give unexpected results."). In the present case, Appellants conclusively established the claimed injector provides improvements over Ni when used for multi-step etching, a use not mentioned in Ni.

The Merits Panel erred in making the following evidentiary finding:

[W]e find no evidence in Ni that the disclosure "instead of using a gas ring or showerhead to supply process gas into the chamber, the gas injector is mounted in an opening through the dielectric window," establishes one of ordinary skill in this art would have been discouraged from considering showerhead injectors having a plurality of chambers for independent control of gas flow in modifying Ni's injector, as Appellants contend. App. Br. 27-28, citing Ni 9:13-15. (Decision at page 21, lines 18-24).

Ni discusses the problem of nonuniform etching using a showerhead (Ni at page 17, line 26 through page 18, line 9) because etch by-products stagnate above the center of the substrate and transport is essentially through diffusion alone (Ni at page 4, lines 9-12; page 17, lines 26-27; page 18, lines 4-9). Ni's injector is an improvement over showerhead arrangements and Ni explicitly states that:

1. The gas injector advantageously allows an operator to modify a process gas supply arrangement . . . to optimize gas distribution in the reactor (Ni at page 14, lines 3-5).
2. Further optimization may involve selecting a gas injector which extends a desired distance below the inner surface of the window and/or includes a particular gas outlet arrangement (Ni at page 14, lines 9-11).
3. Depending on the etching process, the number of gas outlets, the location of the gas outlets such as on the axial end and/or along the sides of the gas injector as well as the angle(s) of injection of the gas outlets can be selected to provide optimum etching results (Ni at page 14, lines 11-14).

It is clear from the disclosure of Ni that a gas injector with a particular gas outlet arrangement can provide improved etch uniformity compared to a showerhead arrangement which suffers the disadvantage of etch by-products stagnating above the center of the substrate. As the Ni injector was designed to be an improvement over a showerhead and in fact operates in a substantively different manner as explained in the Cooperberg Declaration, the record in this case fails to set forth an apparent reason for the Merits Panel's proposed modification of the Ni injector. The Merits Panel's focus on modifications to Ni's injector improperly ignores the claimed plasma processing system as a whole. Goodyear teaches away from supplying process gas from a common source to central and peripheral regions (see Goodyear at column 1, lines 54-61¹ wherein Goodyear criticizes, discredits, and otherwise discourages the use of a common gas source. Contrary to the Merits Panel's flawed evidentiary finding, Goodyear teaches away from supplying the same gas at different flow rates to central and peripheral zones above a substrate. As stated in the omitted background discussion of Goodyear:

¹ This portion of Goodyear is conspicuously absent from the Merit Panel's discussion of Goodyear.

The present inventors find that, in spite of adjusting different flow rates in the peripheral and central areas, significant non-uniformities can still occur in the thickness, composition and quality of deposited film. (Goodyear at column 1, lines 59-62).

Similar non-uniformities can occur in other large area plasma treatments, for example in plasma etching treatments using mixtures of reaction gases for etching over large areas. (Goodyear at column 1, line 66 through column 2, line 2).

It is respectfully submitted that the Merits Panel's reliance on the part of Goodyear that Goodyear explicitly criticizes as providing non-uniform deposition or etching undermines the Merits Panel's rationale for combining Arami, Goodyear and Balance with Ni. It is Appellants position that the portion of Goodyear quoted above establishes lack of substantial evidence in support of the Merits Panel's finding of a motivation to combine. *In re Glaug*, 283 F.3d 1335, 1338, 62 USPQ 1151 (Fed. Cir. 2002) and warrants reversal of the §103 rejections.

IV The Merits Panel Took Substantially Different Positions Than The Examiner With Regard To The Teachings Of The Prior Art And The Weight To Be Given The Cooperberg Declaration

A. If The Decision Is Upheld It Should Be Designated A New Ground Of Rejection Under 37 C.F.R. §§41-50(b)

In the Examiner's Answer, the Examiner gave weight to the claimed "common gas supply" and "supply of process gas from the common gas supply" (see Examiner's Answer at page 8) whereas the Merits Panel took a new position in regard to this claim interpretation issue as explained in Part I. In addition, the Merits Panel took new positions regarding the primary reference Ni.

In the Decision, the following position is taken which differs substantially from the reasoning set forth in the Examiner's Answer:

Ni's disclosure of different arrangements of on- and off-axis gas outlets for aluminum (all off-axis outlets) and polysilicon (one on-axis outlet

and remainder off-axis outlets) etch processes in order to provide desired gas distribution for the processes, would have reasonably suggested to one of ordinary skill in the art that the capability to close off the on-axis gas outlet in the axial end of an injector would result in an injector that can provide desired gas distribution for both aluminum and polysilicon etch processes (Decision at page 19, lines 8-15).

Thus, this person would have readily recognized that a change in the structure of Ni's injector using separate passages or chambers to control the flow of gas to different gas outlets, as known in the art, would facilitate separate control of the on- and off-gas outlets in Ni's injector, thereby permitting the modified injector to be used in different etch processes". (Emphasis added, Decision at page 19, lines 20-25)

In the Examiner's Answer, various deficiencies of Ni are noted but nowhere in the Examiner's Answer is the position taken that Ni "reasonably suggested" the claimed invention.

The Decision also cites KSR for the proposition that "if a technique has been used to improve one device . . . using the technique is obvious . . ." (Decision at page 19, line 25 - page 20, line 4). The Decision cites the secondary references Chang, Murugesh, Arami, Goodyear and Balance as "knowledge in the art that an injector can be divided into passages or chambers in order to regulate gas flow and the composition of that gas" (Decision at page 19, lines 16-20). However, because KSR was decided after the Examiner's Answer was issued, the Merits Panel took substantially different positions in combining the cited references than the Examiner in upholding the §103 rejections.

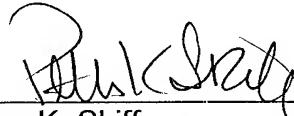
V. **Conclusion**

For the foregoing reasons, Appellants respectfully request that the §103 rejections be reversed and if the Decision is maintained it should be designated a new ground of rejection.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: April 27, 2009

By: 
Peter K. Skiff
Registration No. 31917

P.O. Box 1404
Alexandria, VA 22313-1404
(703) 836-6620